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## Teaching biogeographic concepts and conservation biogeography

1<sup>st</sup> Symposium of Systematics and Biogeography of Minas Gerais State — Diamantina, Brazil, 15<sup>th</sup>–17<sup>th</sup> October 2012

Systematics and biogeography are two fields of natural sciences which have grown considerably in recent years. Both disciplines have been instrumental in driving knowledge of the Brazilian Cerrado, a global hotspot for biodiversity (Myers et al. 2000), and especially the Espinhaço Mountain Range. This range, at more than 1200 km, represents the longest orogenic belt of Brazil. The landscape is composed of a mosaic of bare exposed rocks and dense, mainly riparian, forests. It is a unique region housing many endemic species and its southern portion provided a spectacular backdrop for the 1<sup>st</sup> Symposium of Systematics and Biogeography which was convened in part to redress the still limited disciplinary training available for undergraduate students despite the rapid development of biogeography in Brazil.

The relationship between *Systematics and Biogeography* was considered first by outlining the historical development of Comparative Biology, stressing the importance of taxonomy and its profound impact in studies of evolution and biogeography. Modern biogeography was invigorated by León Croizat, who famously recognized that “Life and Earth evolve together” (Croizat, 1964), and thus Eduardo Almeida (University of São Paulo) posited that all biogeographers are, ultimately, systematic researchers of specific organisms. That topic was complemented by consideration of the historical development of biogeography, including the importance of biogeographical methods for investigating dispersal or vicariant events, the latter analyzed under panbiogeographic or cladistic perspectives (Silvio Nihei, University of São Paulo). Subsequently, both Almeida and Nihei discussed the current state of biogeography in Brazil, illustrating important contributions by development of computer programs for biogeographic analysis and the chronology of the highest impact publications. These accomplishments contrast with the lack of recognition of biogeography as a post-graduate subject in Brazil and the lack of support for PhD researchers, which

may in the future constrain biogeographic knowledge in Brazil. Almeida and Nihei also highlighted the possible unhealthy trade-off between quantity and quality of knowledge driven by the ‘publish-or-perish’ culture that is becoming ever more apparent in Brazilian institutions. Better understanding of cutting edge biogeographical methods among Brazilian students and researchers is essential to move beyond simplistic hypotheses for distinct taxa.

Discussion subsequently focused on *Geographical Distribution Areas and Endemism*, a topic introduced by Márcio Bernardino da Silva (Federal University of Paraíba) talking about the development of the endemism concept. In the early 18<sup>th</sup> Century, biogeographers considered areas of endemism as simply species ranges delimited by geographical barriers. Today, areas of endemism are the basic working unit of historical biogeography, and their delimitation is of fundamental importance. Silva presented his own research on endemic areas in the Atlantic Forest using harvestman. Gleyce Dutra (Federal University of Jequitinhonha and Mucuri Valleys [UFVJM]) then outlined the importance of geoprocessing tools for species distribution modeling (SDM) methods, stressing the difference between the actual niche, realized niche, and fundamental niche, and that the precision of predicted distributions is dependent on the amount and quality of the input data. She then demonstrated the efficiency of SDM compared to the still widespread practice of uniting points of occurrence. Silva and Dutra debated the use of endemic areas as a premise for delimiting areas for conservation. Silva argued that, despite the wide availability of various tools for delimiting endemic areas, they are not being incorporated into conservation policy. Dutra cautioned about the misapplication of such tools for making conservation decisions.

These concepts were illustrated by case studies in modern biogeography of the Cerrado and the Espinhaço Mountain Range. Growth in

systematic and biogeographic research was illustrated using the morphologically homogeneous and highly homoplasious Mygalomorph spiders (José Paulo Guadanucci, UFVJM) which includes three sympatric *Oligoxystre* species in the Diamantina region suggesting distinct biogeographic events between Cerrado/Caatinga and Cerrado/Amazon (Guadanucci, 2011). The potential of freshwater microinvertebrates (Gastrotricha, Copepoda, Rotifera, Tardigrada) for delimiting areas of endemism in the hydrographic basins of Minas Gerais was demonstrated by applying Echeverry and Morrone's (2010) method, which uses parsimony analysis of endemism (PAE) with a panbiogeographic approach (André Garraffoni, UFVJM). This strategy has the advantage of a low rate of information loss regarding the relationship between area and taxon for species with few locality records, and preliminary analyses revealed that most of the 270 documented species had a single or few records, and that the main basins did not share exclusive species. Renata Ribeiro (UFVJM) illustrated concepts, methods, and inference in phylogeography by presenting the results of studies with the plant *Dalbergia nigra* from the Brazilian Cerrado demonstrating the existence of two distinct populations (northern and southern) possibly related to vicariant events caused by climate changes during the Quaternary. The symposium included oral presentations by four undergraduate and post-graduate students: sympatry of two small mammal species at Diamantina Plateau, a distinct region within the southern part of Espinhaço Range (Leonardo Lessa), the delimitation of endemic areas for spiders and bees in the Atlantic Forest (Tatiane Rodrigues, Filipe Moura), and a new method for delimiting endemic areas without the use of grids (Ubirajara de Oliveira). A combination of different methods—PAE, Endemism Analysis, track analysis—demonstrated that organisms often have not been sufficiently sampled over significant parts of the Brazilian Cerrado.

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See *Announcements* for information on the 2<sup>nd</sup> *Symposium of Systematics and Biogeography of Minas Gerais State*.